

Descriptive Summary of the Changes in Coastal Massachusetts, June 7, 1991, to June 23, 1997

Historically, land cover change has been occurring in this region for almost four hundred years. Human influence was evident in the small, scattered changes that occurred in many different places, due primarily to development pressures. However, forested lands still dominated the landscape of Massachusetts with over 2.3 million acres (approximately 29 percent of the land) covered by deciduous, mixed, and evergreen forests.

At over 65,000 acres, forest transformations constituted the greatest change detected by the C-CAP land cover analysis in Massachusetts. The majority of the 65,000 acres of forest conversion documented between 1991 and 1997 was attributed to human development. Forest changes due to development pressures were evidenced by the direct conversion of over 22,000 acres of forest to high and low intensity development. Transitional forest changes included over 20,000 acres converted to grassland and over 21,000 acres to scrub/shrub as forested areas were cleared and prepared for development.

When forests are converted to low intensity development, such as residential neighborhoods, the impact to the affected forests may be less because, typically, 20 to 50 percent of the vegetative cover remains in residential neighborhoods through the incorporation of large yards, parks, trees, and open spaces. High intensity development, such as industrial parks, parking lots, and highways, impacts once-forested areas severely as the area is no longer predominated by vegetation; rather the landscape is dominated by buildings and paved surfaces. As of 1997, combined high and low intensity developed areas characterized over 560,000 acres, or 7 percent of the data set.

A smaller component of forest change captured in the Massachusetts data set was indicative of the cyclic silviculture process, which involves the harvest and reforestation of evergreen tree stands. These changes were often captured as forests changing to grasslands, the grasslands growing to scrub/shrub, and eventually the scrub/shrub returning to mature forests. However, silviculture is not a major industry in Massachusetts and only a small portion of the landscape, about 13,000 acres, appeared to be in this cycle.

Below are three tables. The first two tables contain a data summary for the time 1 and time 2 images. These images were used to create the change image and their tables include; land cover classes, the number of pixels present in each class, and their corresponding values in acres.

The third table is a complete change matrix for time 1 and time 2 images and includes a smaller, generalized table, which groups similar classes together. Table three compares each class from time 1 to time 2 and illustrates the change that took place between

classes. The table presents the total acres for each class, the total percent that each class represents, the total acres that changed, and the percent of change they represent.

Tabular Summary: Massachusetts, June 7, 1991

| | CLASS | PIXELS | ACRES | PERCENT |
|----|--------------------------------|-----------------|----------------|----------------|
| 0 | Background | 0 | 0 | 0.00% |
| 1 | Unclassified | 0 | 0 | 0.00% |
| 2 | High Intensity Developed | 934820 | 207898 | 2.51% |
| 3 | Low Intensity Developed | 1451314 | 322763 | 3.89% |
| 4 | Cultivated Land | 90994 | 20237 | 0.24% |
| 5 | Grassland | 2470151 | 549347 | 6.63% |
| 6 | Deciduous Forest | 7830911 | 1741547 | 21.01% |
| 7 | Evergreen Forest | 1035674 | 230328 | 2.78% |
| 8 | Mixed Forest | 2070979 | 460573 | 5.56% |
| 9 | Scrub/Shrub | 1646853 | 366250 | 4.42% |
| 10 | Palustrine Forested Wetland | 1335594 | 297028 | 3.58% |
| 11 | Palustrine Scrub/Shrub Wetland | 260826 | 58006 | 0.70% |
| 12 | Palustrine Emergent Wetland | 99196 | 22061 | 0.27% |
| 13 | Estuarine Forested Wetland | 0 | 0 | 0.00% |
| 14 | Estuarine Scrub/Shrub Wetland | 0 | 0 | 0.00% |
| 15 | Estuarine Emergent Wetland | 148925 | 33120 | 0.40% |
| 16 | Unconsolidated Shore | 91055 | 20250 | 0.24% |
| 17 | Bare Land | 107430 | 23892 | 0.29% |
| 18 | Water | 17697976 | 3935922 | 47.48% |
| 19 | Palustrine Aquatic Bed | 0 | 0 | 0.00% |
| 20 | Estuarine Aquatic Bed | 0 | 0 | 0.00% |
| 21 | Tundra | 0 | 0 | 0.00% |
| 22 | Snow/Ice | 0 | 0 | 0.00% |
| | TOTALS | 37272698 | 8289222 | 100.00% |

Tabular Summary: Massachusetts, June 23, 1997

| | CLASS | PIXELS | ACRES | PERCENT |
|----|--------------------------------|-----------------|----------------|----------------|
| 0 | Background | 0 | 0 | 0.00% |
| 1 | Unclassified | 0 | 0 | 0.00% |
| 2 | High Intensity Developed | 990546 | 220291 | 2.66% |
| 3 | Low Intensity Developed | 1561570 | 347284 | 4.19% |
| 4 | Cultivated Land | 101981 | 22680 | 0.27% |
| 5 | Grassland | 2481431 | 551855 | 6.66% |
| 6 | Deciduous Forest | 7643148 | 1699790 | 20.51% |
| 7 | Evergreen Forest | 1005037 | 223514 | 2.70% |
| 8 | Mixed Forest | 2006041 | 446131 | 5.38% |
| 9 | Scrub/Shrub | 1744390 | 387942 | 4.68% |
| 10 | Palustrine Forested Wetland | 1333596 | 296584 | 3.58% |
| 11 | Palustrine Scrub/Shrub Wetland | 259353 | 57679 | 0.70% |
| 12 | Palustrine Emergent Wetland | 97346 | 21649 | 0.26% |
| 13 | Estuarine Forested Wetland | 0 | 0 | 0.00% |
| 14 | Estuarine Scrub/Shrub Wetland | 0 | 0 | 0.00% |
| 15 | Estuarine Emergent Wetland | 149136 | 33167 | 0.40% |
| 16 | Unconsolidated Shore | 93162 | 20719 | 0.25% |
| 17 | Bare Land | 111428 | 24781 | 0.30% |
| 18 | Water | 17694533 | 3935157 | 47.47% |
| 19 | Palustrine Aquatic Bed | 0 | 0 | 0.00% |
| 20 | Estuarine Aquatic bed | 0 | 0 | 0.00% |
| 21 | Tundra | 0 | 0 | 0.00% |
| 22 | Snow/Ice | 0 | 0 | 0.00% |
| | TOTALS | 37272698 | 8289222 | 100.00% |

Change Matrix and Tabular Summary:Massachusetts from June 7, 1991 to June 23, 1997

| | FROM / TO | High Intensity Developed | Low Intensity Developed | Cultivated Land | Grassland | Deciduous Forest | Evergreen Forest | Mixed Forest | Scrub/Shrub | Palustrine Forested Wetland | Palustrine Scrub/Shrub Wetland | Palustrine Emergent Wetland | Estuarine Forested Wetland | Estuarine Scrub/Shrub Wetland | Estuarine Emergent Wetland | Unconsolidated Shore | Bare Land | Palustrine Aquatic Bed | Water | Palustrine Aquatic Bed | Estuarine Aquatic Bed | Tundra | Snowlice | Total Acres | Changed | | |
|----------------------------------|--------------------------------|--------------------------|-------------------------|-----------------|-----------|------------------|------------------|--------------|-------------|-----------------------------|--------------------------------|-----------------------------|----------------------------|-------------------------------|----------------------------|----------------------|-----------|------------------------|-----------|------------------------|-----------------------|--------|----------|-------------|------------------|--------------------------------|------------------------|
| 2 | High Intensity Developed | 207898 | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 207,898 | 0 | High Intensity Developed | |
| 3 | Low Intensity Developed | 123 | 322649 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 322,783 | 153 | Low Intensity Developed | |
| 4 | Cultivated Land | 3 | 0 | 19939 | 239 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 355 | 0 | 0 | 0 | 0 | 0 | 20,237 | 897 | Cultivated Land | |
| 5 | Grassland | 320,1 | 3996 | 520 | 524998 | 0 | 0 | 0 | 14019 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 175 | 2438 | 0 | 0 | 0 | 0 | 0 | 549,347 | 24,349 | Grassland | |
| 6 | Deciduous Forest | 3,159 | 10007 | 84 | 15450 | 109950 | 0 | 0 | 13083 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 82 | 1741 | 0 | 0 | 0 | 0 | 0 | 1,741,844 | 43,494 | Deciduous Forest | |
| 7 | Evergreen Forest | 548 | 2491 | 185 | 1512 | 0 | 222998 | 0 | 2482 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 28 | 239 | 0 | 0 | 0 | 0 | 0 | 239,327 | 7,429 | Evergreen Forest | |
| 8 | Mixed Forest | 1093 | 4605 | 369 | 3730 | 0 | 44689 | 0 | 2655 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 34 | 399 | 0 | 0 | 0 | 0 | 0 | 460,873 | 15,890 | Mixed Forest | |
| 9 | Scrub/Shrub | 3820 | 2249 | 1345 | 1749 | 1730 | 612 | 1440 | 303841 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 148 | 1271 | 0 | 0 | 0 | 0 | 0 | 366,250 | 14,449 | Scrub/Shrub | |
| 10 | Palustrine Forested Wetland | 12 | 24 | 33 | 268 | 6 | 3 | 8 | 79 | 290493 | 0 | 30 | 24 | 0 | 0 | 0 | 2 | 17 | 28 | 0 | 0 | 0 | 0 | 297,828 | 535 | Palustrine Forested Wetland | |
| 11 | Palustrine Scrub/Shrub Wetland | 0 | 0 | 24 | 121 | 0 | 0 | 0 | 144 | 91 | 57497 | 83 | 0 | 0 | 0 | 0 | 0 | 3 | 33 | 0 | 0 | 0 | 0 | 58,006 | 589 | Palustrine Scrub/Shrub Wetland | |
| 12 | Palustrine Emergent Wetland | 1 | 0 | 73 | 302 | 0 | 0 | 0 | 3 | 0 | 105 | 21905 | 0 | 0 | 0 | 0 | 0 | 34 | 37 | 0 | 0 | 0 | 0 | 22,061 | 866 | Palustrine Emergent Wetland | |
| 13 | Estuarine Forested Wetland | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | Estuarine Forested Wetland | |
| 14 | Estuarine Scrub/Shrub Wetland | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | Estuarine Scrub/Shrub Wetland | |
| 15 | Estuarine Emergent Wetland | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 33098 | 0 | 84 | 0 | 0 | 0 | 0 | 0 | 0 | 33,129 | 84 | Estuarine Emergent Wetland | |
| 16 | Unconsolidated Shore | 0 | 0 | 29 | 237 | 0 | 0 | 0 | 111 | 0 | 0 | 0 | 0 | 0 | 0 | 87 | 19999 | 199 | 0 | 0 | 0 | 0 | 0 | 20,236 | 664 | Unconsolidated Shore | |
| 17 | Bare Land | 334 | 703 | 355 | 3177 | 0 | 0 | 0 | 507 | 0 | 48 | 28 | 0 | 0 | 0 | 5 | 85 | 19534 | 118 | 0 | 0 | 0 | 0 | 23,892 | 5,388 | Bare Land | |
| 18 | Water | 0 | 190 | 54 | 15 | 119 | 0 | 0 | 0 | 29 | 0 | 0 | 0 | 0 | 0 | 39 | 589 | 39 | 399498 | 0 | 0 | 0 | 0 | 0 | 3,935,921 | 981 | Water |
| 19 | Palustrine Aquatic Bed | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | Palustrine Aquatic Bed |
| 20 | Estuarine Aquatic Bed | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | Estuarine Aquatic Bed |
| 21 | Tundra | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | Tundra |
| 22 | Snowlice | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | Snowlice |
| Total Acres | | 229,291 | 347,284 | 22,680 | 581,895 | 1,699,787 | 223,614 | 446,132 | 387,942 | 296,884 | 87,879 | 21,849 | 0 | 0 | 0 | 33,167 | 20,719 | 24,791 | 3,935,185 | 0 | 0 | 0 | 0 | 4,354,278 | 0 | Total Acres | |
| Percent of Total | | 5.08% | 7.98% | 0.52% | 12.67% | 39.34% | 6.13% | 10.32% | 8.91% | 6.91% | 1.32% | 5.89% | 0.00% | 0.00% | 0.76% | 0.00% | 0.49% | 0.57% | 90.37% | 0.00% | 0.00% | 0.00% | 0.00% | 114.989 | Percent of Total | | |
| Total Acres that Changed (Y2-Y1) | | 12,393 | 24,529 | 2,443 | 2,509 | -41,757 | -6,813 | -14,442 | 21,892 | -444 | -328 | -411 | 0 | 0 | 47 | 489 | 889 | 766 | 0 | 0 | 0 | 0 | 0 | 0 | 114,989 | Total Acres that Changed | |
| Percent Change | | 5.39% | 7.00% | 12.07% | 0.46% | -2.46% | -2.96% | -3.14% | 5.92% | -0.15% | -0.36% | -1.86% | 0 | 0 | 0.14% | 2.31% | 3.72% | -0.02% | 0 | 0 | 0 | 0 | 0 | 0 | 2.64% | Percent Change | |

| FROM / TO | Developed | Cultivated | Grassland | Forested | Scrub/Shrub | Wetlands | Bare | Water | Total Acres | Changed | |
|-----------------------------|-----------|------------|-----------|-----------|-------------|----------|---------|-----------|-------------|-----------|-------------|
| Developed | 430,683 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 539,861 | 0 | Developed |
| Cultivated | 1 | 19,638 | 239 | 0 | 0 | 0 | 355 | 0 | 20,237 | 897 | Cultivated |
| Grassland | 7,198 | 520 | 524,998 | 0 | 14,019 | 0 | 2,612 | 0 | 549,347 | 24,349 | Grassland |
| Forested | 22,408 | 881 | 20,913 | 2,662,162 | 21,317 | 0 | 1,861 | 28 | 2,729,499 | 67,388 | Forested |
| Scrub/Shrub | 6,113 | 3,368 | 1,870 | 3,874 | 408,682 | 184 | 1,422 | 33 | 424,347 | 14,865 | Scrub/Shrub |
| Wetlands | 38 | 129 | 692 | 18 | 226 | 408,874 | 139 | 99 | 410,215 | 1,341 | Wetlands |
| Bare | 1,037 | 385 | 3,414 | 0 | 684 | 166 | 38,405 | 116 | 44,188 | 5,783 | Bare |
| Water | 153 | 15 | 3,177 | 0 | 29 | 39 | 626 | 3,934,985 | 3,938,979 | 118,283 | Water |
| Total Acres | | 587,611 | 22,738 | 585,304 | 2,666,035 | 445,738 | 409,282 | 45,821 | 3,935,217 | 4,354,278 | Total Acres |
| Percent of Total (Y2/Total) | | 13.04% | 0.58% | 12.78% | 61.23% | 10.24% | 9.40% | 1.05% | 96.38% | 2.72% | |
| Total Change (Y2-Y1) | | 36,990 | 2,090 | 5,957 | -63,418 | 21,391 | -893 | 1,333 | -3,762 | 118,283 | |
| Percent Change | | 6.28% | 9.19% | 1.01% | -2.38% | 4.78% | -0.20% | 0.30% | -0.90% | 2.72% | |